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Draft Interim Guidelines

for the Utilization of Waste

(Other Than Sewage Sludge)

on Agricultural Lands

**PREPARED BY THE
SLUDGE AND WASTE UTILIZATION COMMITTEE
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Ministry
of Agriculture
and Food

Ministry
of the
Environment



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The Ontario Ministry of Health
The Department of Land Resource Science, University of Guelph
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The Ontario Municipal Engineers Association
The Ontario Municipal Liaison Committee
The Ontario Soil and Crop Improvement Association
The Association of Local Official Health Agencies
Environment Canada
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FOREWORD

Purpose

These Guidelines outline the criteria governing the quality, use, and application rates allowed for spreading liquid and solid waste materials on agricultural land in Ontario. Some off-farm wastes have value in improving soil quality, in enhancing crop production or in promoting ground cover, while others can be detrimental. It is the intent of these guidelines to provide a basis for distinguishing between beneficial and detrimental wastes. The guidelines are, therefore, of interest to producers of recyclable waste, municipalities and the staff of the three participating Ontario Government Ministries - Agriculture and Food, Health and Environment. The Guidelines may be of special interest by helping municipalities and industry to decide which wastes are potentially eligible for landspreading and which must be disposed of in other ways.

Future Waste Use

Approvals, for the land use of wastes, will be given on a waste-by-waste basis for the time being. There are no guarantees that all wastes of the same type have the same constituents and it will never be possible to make such an assumption. As experience is accumulated, it is expected that, for certain groups of wastes, their potentially beneficial and potentially detrimental constituents will become recognized.

Once the knowledge has been accumulated, addenda covering specific wastes will be issued. At the present time, the development of addenda covering composted materials and sludges from paper processing is under consideration.

Principles Underlying Waste Application

These Guidelines require that wastes utilized on agricultural land must benefit crop production and pose minimal risks to:

1. Plant growth;
2. Crop quality;
3. Long-term land productivity;
4. Public and animal health; and
5. The quality of the environment.

If a waste fails these criteria, it must not be spread on agricultural land and must be disposed of in other ways. Before a waste is judged potentially beneficial to agriculture, its quality should first be assessed through a review of the following constituents:

1. Nitrogen (especially ammonium and nitrate compounds);
2. Phosphorus;
3. Potassium;
4. Other macro and micro nutrients essential for crop growth; and
5. Organic material, which benefits or improves most soils.

Procedures

Producers of waste must, before receiving an approval issued under the *Environmental Protection Act*, meet with MOE Regional staff to discuss the utilization of their specific waste. OMAF local staff may also be able to assist. Waste Reduction Office staff will assist Regional staff as required and assist in liaison with the "Sludge and Waste Utilization Committee". For this purpose, the producer of the waste should provide information on the type, quantity and composition of each waste produced. Both MOE and OMAF local offices can supply further information and application forms. The producer of the waste must recognize that some constituents may be either potentially beneficial or potentially injurious (e.g. industrial organic contaminants) and that full information, on both the wastes and the processes used to produce them, may be required.

User Comment and Suggestions on these Guidelines

The participating Ministries will welcome comments and suggestions aimed at making these guidelines more useful and practicable. Suggestions or comments may be sent to the MOE's Assistant Deputy Minister for Waste Reduction or to the Director of OMAF's Resources Management Branch, for forwarding to the Co-chairpersons of the Sludge and Waste Utilization Committee. In reviewing comments and suggestions, the Committee will take into account the requirements for environmental protection and maintenance and enhancement of crop quality and land productivity.

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1.0

PURPOSE, INTENT, OBJECTIVE, SCOPE AND AUTHORITY

These guidelines supplement regulation 309, made under the *Environmental Protection Act*. Their *purpose and objective* is to define the criteria which must be met before recycling and use of suitable waste on agricultural land can be considered. Their *intent* is:

- To promote waste utilization and to prevent the disposal on farmland of wastes which can have detrimental effects; and
- To benefit crops and protect the productivity of farmland and food quality, without degrading the environment or placing at risk the health of animals or residents of Ontario.
- To contribute to the overall protection and promotion of the public health of Ontario residents.

The Ministry of the Environment (MOE) will allow spreading of only those wastes which will benefit crop production or soil productivity. To be useful for land application, wastes should supply needed plant nutrients and/or organic matter, or assist in maintaining a desirable soil pH. The addition of organic matter to most soils improves the soil structure, water holding capacity and general productivity. Acid soils may benefit from the addition of calcium carbonate. On very rare occasions, as for example in the production of blueberries, an increase of soil acidity may be beneficial. Plant nutrients include nitrogen, phosphorus, potassium, calcium, magnesium, boron, copper, manganese, molybdenum and zinc.*

The *scope* of these guidelines encompasses the quality, application and use of waste but does not include agricultural waste. These guidelines should be used to assess applications and to issue or refuse Certificates of Approval.

2.0

PROCEDURAL REQUIREMENTS

2.1 Environmental Protection Act and Regulation 309

In Ontario all waste must, with certain exceptions, be disposed of at certified waste disposal sites. In addition, sites used to store wastes and the systems used to transport them must be certified.

Part V of the *Environmental Protection Act* and Ontario Regulation 309 provide the MOE with the authority to control the disposition of wastes. The Act requires that disposers of waste apply for Certificates of Approval; it allows an MOE Director to issue or revoke Certificates and impose whatever conditions

* Sulphur, chlorine and iron are also plant nutrients, but their addition to most Ontario soils is unlikely to improve crop growth.

may be necessary to safeguard the environment. Part V of the Act prescribes the conditions governing Environmental Hearings and, together with provisions in Part XIV, prescribes penalties for non-compliance.

An appropriate Certificate of Approval must be in effect when wastes are:

- Transported (i.e. a Waste Management System is used);
- Temporarily stored away from the location where they were generated (i.e. at a Transfer Station); or
- Disposed of at waste processing facilities, Landfilling Sites or Utilization Sites.

Certificates of Approval, for sites at which wastes are utilized, will be issued on a case-by-case basis.

(Approval will be sought at a later stage)

2.2 Procedures for Waste Producers

Producers of potentially usable wastes should take the steps outlined herein to obtain acceptance and approval for their proposals. They should also be pro-active in securing acceptance and co-operation from the public, agricultural producers and municipalities, during both the preliminary and experimental stages and after issuance of Certificates of Approval.

The procedures described below are those which MOE intends to put in place immediately after these guidelines are published. However, as experience is gained in the use of these procedures, variations may be introduced. Waste producers should check with their local MOE Office to see if there have been changes.

Before wastes can be spread on land, the producer or person having charge of the wastes must have an approval for a type of Waste Disposal Site known as an 'Organic Soil Conditioning Site'. To receive this approval, they must supply details of their proposal to the local MOE Office. The nature of these details, and advice and information which will assist the waste producer in securing approvals, can be obtained from both MOE and OMAF local Offices.

Initially, the waste producer may ask MOE for 'in principal' approval to use a particular type of waste. Through an agronomist, it must be also demonstrated that agriculture will benefit. By proceeding in this way, the waste producer will initially have to provide less information than is required for a full approval; hence some of the costs may be deferred until it is known that the waste can be used. However, if a specific site is not proposed, the waste producer may find it more difficult to demonstrate that agriculture will benefit. In addition, the waste producer will need information about the soil types and crops and to find out if using a particular waste is practical and economically feasible.

Because the waste producer must also obtain a specific approval for each location proposed to use the wastes, 'in-principle' approval and the site approval should be asked for at the same time.

The local office of MOE is the agency through which the Certificate of Approval is issued. However, this office first asks the Sludge and Waste Utilization Committee (SWUC) to endorse, not only the acceptability of the waste for agricultural use but also for the application rates, spreading procedures and fields where it is used. This Committee and its Screening Subcommittee, to which all proposals are referred, each meet at intervals of about 6 to 8 weeks. Because each waste is different, analyses additional to those specified in the information package for waste producers are sometimes needed. In addition, clarification of information already provided by the waste producer may be required. As a result there may sometimes be considerable delays between a request for approvals and a response. Details of how information will be handled are provided in Figure 1.

a. Analytical Requirements

The waste producer submits all analyses necessary to identify all the components and concentrations of nutrients and other constituents which are potentially useful or beneficial in agricultural production, such as nitrogen, phosphorus, potassium, organic matter etc. Documents available from local MOE or OMAF Offices provide information about normal analysis needs, for both the waste and the soil.

When more information becomes available, these guidelines will be expanded to include analyses for harmful constituents in specific types of wastes and their permissible concentrations. In the meantime MOE, in consultation with SWUC, will determine if additional analyses are needed on a waste-by-waste basis.

b. Assessing Markets, Demands and Suitability

The waste producer should establish the waste material's potential benefits to agriculture and make preliminary and tentative enquiries about the need for and acceptability of the waste material among local agricultural producers. Initially, advice should be sought from an experienced agronomist in OMAF's Plant Industry Branch or other suitably qualified specialists.

The agrologist's report should cover:

- the needs for greenhouse and field testing, and for demonstration projects;
- the rationale which will be used to determine waste application rates (which will normally be based on the provisions of the OMAF publications 296, 360 and 362, which deal with field crops, fruit and vegetables respectively);
- the acceptability of the wastes to local agricultural producers for use on their lands; and
- provisions needed to protect workers and the public's health.

The proponent should also obtain information from MOE staff about the approval processes which must precede the use of the waste on agricultural land.

c. Monitoring and Quality Control

When required by MOE, the waste producer will make arrangements for a suitable field monitoring program and for routine analyses of parameters of potential concern.

However, for some wastes, little monitoring and few analyses may be required. The waste producer must ensure that each batch produced and/or each load hauled is of the same uniform consistent acceptable quality.

d. Submissions

MOE staff, to whom the waste producer must apply directly for approvals, should consult with SWUC. This Committee will review and advise MOE on the submissions. Its final recommendations will be based on data, which may include field testing results, for both beneficial and potentially harmful constituents.

e. Certification and Approval of Spreading Operations

Before spreading can be approved, MOE must be satisfied that the application of the waste will not conflict with any legislation and that it will benefit agriculture. Spreading may commence only after laboratory testing and, if required, greenhouse and field testing, have proven the use of the wastes to be acceptable.

Approvals (when experimentation and field testing are to be conducted) may be given under the *Environmental Protection Act* by means of a Director's letter authorizing the 'experimental' application of wastes.

However, when routine application of wastes is commenced, Certificates of Approval for "Organic Soil Conditioning Sites" for the locations where the waste is to be used and for waste haulage (Waste Management Systems) in accordance with the requirements of the *Environmental Protection Act* and Ontario Regulation 309 are required.

3.0

CRITERIA RELATING TO WASTE PROCESSING

All waste applied to agricultural land must have an acceptably low potential to generate odours and must contain acceptably low concentrations of organisms pathogenic to man or animals.

When there is a need to reduce odour potential or the numbers of pathogenic organisms, anaerobic and aerobic digestion processes may sometimes provide satisfactory waste stabilization. In general, wastes may be considered as appropriately stabilized, provided that:

- Odours, after spreading these wastes, are no more objectionable than those arising from other normal farming practices; and

- The pathogenic content of the wastes is no greater than that of digested sewage sludge. For acceptable wastes, containing low pathogen concentrations, waiting periods similar to those indicated in Table 1 of the "Guidelines for Sewage Sludge Utilization on Agricultural Lands" may be required. Similarly, distances, as indicated in Tables 5 and 6 of the above guidelines, may also be required from water courses, wells and residences. Many industrial wastes do not have objectionable odours and do not contain pathogens. For such wastes, stabilization will not be required and separation distances from water courses, wells and residences may be less than those required for sewage sludge.

When odours are of potential concern and the adequacy of the stabilization processes is assessed, the method and timing of any processes used to incorporate the wastes into soil will be taken into account.

4.0

CRITERIA RELATING TO WASTE CONSTITUENTS

Analyses, for harmful constituents as determined on a case-by-case basis, will be required to determine the levels of potentially toxic substances, including specific industrial inorganic and organic materials. Concentrations of toxic compounds in the waste material must be sufficiently low that they do not result in excessively high future concentrations in the soil.

The analyses will be conducted at a frequency approved by MOE. The analysis information about the range of nutrient content and quality in the processed wastes applied to their lands is to be given to agricultural producers. Analyses may be required, not only before MOE issues an approval, but on an ongoing basis. The contents of any sample submitted for analysis shall be representative of the batch for which spreading is proposed. In order to help MOE staff verify that appropriate analyses have been conducted, the proponent should be prepared, on request, to furnish information about the processes and chemicals used at the manufacturing facility and the chemicals which are likely to be present in the waste. The proponent should, also on request, permit MOE staff to obtain samples from the waste stream for analysis in MOE laboratories.

For wastes supplying a significant portion of the crop requirement for nitrogen, ongoing analyses to identify the total and ammonium plus nitrate nitrogen content may be required. Sufficient analyses should be conducted to permit the actual nitrogen content to be estimated within 25%. Ongoing analyses will also be required for wastes supplying a significant portion of crop requirements for other nutrients, or for environmentally significant concentrations of other elements or compounds. Information about crop requirements is provided in OMAF publications 296 (Field Crop Recommendations), 360 (Fruit Production Recommendations) and 362 (Vegetable Production Recommendations).

4.1 Potentially Undesirable Constituents

4.1.1 Metals of Principle Concern to Agricultural

The metals in sewage sludge, of principal concern to agriculture, are arsenic, cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead, selenium and zinc. Wastes are deemed acceptable, for application to agricultural land, only when the metal application rates and the soil metal concentrations conform with Table 1.

Other metals may also be of concern; criteria will be assessed on a case-by-case basis.

4.1.2 Lands Accepting Wastes From Two Or More Different Sources

Two or more different wastes from different sources, each of which has some benefit to agriculture, e.g. sewage sludge and leaves, may be spread on the same parcel of agricultural land either after blending or in separate uniform layers. The total metal application rates from the several wastes may not exceed the 5-year maximum metal application rates specified in Table 1. The acceptability of such spreading will be assessed on a case-by-case basis.

4.1.3 Waste Containing Sodium

Wastes, such as those from the food processing industry, frequently contain appreciable amounts of sodium. Unduly high concentrations of sodium can cause soil structure to deteriorate markedly. From a practical standpoint, such deterioration may be irreversible. Consequently, wastes applied to agricultural land must conform with the following sodium criteria in Table 2.

When sodium additions exceed 50% of the above values:

- Soils should be well drained, imperfectly drained or tile drained; and
- After the wastes have been applied in any 2 calendar years, further applications of high-sodium waste shall be permitted only if soil sodium and the electrical conductivity of the soil solution are monitored annually. Exchangeable sodium in the soil must not be allowed to exceed 5% of the soil's total cation exchange capacity. Soil conductivity, measured on a saturation extract, should not exceed 2.0 millisiemens per centimetre or, if measured in a 2:1 water to soil suspension, should not exceed 0.45 millisiemens per centimetre.

4.1.4 pH

The pH of any material applied to an established crop should not exceed 8.5 or be less than 6.0.

4.1.5 Wastes Containing Boron

Wastes supplying more than 1 kg of boron per hectare per year are not acceptable for many crops, because of potential boron toxicity. For boron-tolerant crops grown on boron-deficient soils the maximum acceptable application rate is 2kg per hectare per year. Hot water soluble boron concentrations in the soil should not exceed 1 mg/1 for boron-tolerant crops.

4.1.6

Wastes Containing Other Elements

Analytical information about other elements may be needed, to assist the proponent and MOE in assessing a waste's suitability. The proponent will be required to furnish appropriate documentation upon request.

4.1.7

Wastes Containing Industrial Organics

When wastes are produced by chemical manufacturing processes, results of analyses for industrial organic contaminants will be required before approval for land application can be considered. For wastes produced by mechanical manufacturing processes, e.g. some food product wastes, such analyses may not be required.

At present, there are significant gaps in knowledge about the impacts of industrial organic contaminants contained in waste or other materials applied to agricultural land.

The permissible concentration of each industrial organic contaminant will be assessed on a waste-by-waste basis.

As experience is amassed and as relevant research results are reviewed, standards will be established to govern:

- the permissible concentrations of industrial organic contaminants in waste materials which are to be land-applied;
- the permissible maximum application rates for these contaminants; and
- the maximum permissible concentrations of these contaminants in waste-amended soils.

The land application of wastes containing high concentrations of industrial organic chemicals will not be permitted.

4.2 Plant Nutrient Criteria

4.2.1

Nitrogen

Nitrogen is a valuable constituent which may be present in the ammonium, nitrate and organic forms. Ammonium plus nitrate nitrogen is a rough measure of the nitrogen immediately available for crop use. Unless the wastes are immediately incorporated into the soil, up to 50% of the ammonium nitrogen can be lost by volatilization. Gradual conversion of organic nitrogen, when present in the waste, to ammonium and nitrate nitrogen, may compensate for volatilization losses. In general, the most efficient use of ammonium and nitrate nitrogen for crop growth occurs in the spring.

The amount of ammonium plus nitrate nitrogen which may be supplied to the soil by waste application is limited, to protect both ground water quality and crop quality.

Nitrogen applications should not exceed the nitrogen fertilizer recommendation for the crops, as indicated in the OMAF Publications 296, 360 and 363.

4.2.2

Phosphorus

The acid soluble phosphorous content of the waste should be determined. Wastes may not be applied to soils containing more than 60 milligrams of sodium bicarbonate extractable phosphorus per litre (using the Olsen test) in the top 15 centimetres.

4.2.3

Potassium

Potassium application rates should be evaluated on a case-by-case basis.

4.2.4

Other Nutrients

Prior to the approval of land application of wastes with high concentrations of other plant nutrients, farmers, OMAF and MOE staff should use soil analyses to verify that crop production and quality will not be affected detrimentally. Application rates may have to be adjusted for individual soils and crops.

4.3 Wastes Rich in Organic Matter

Wastes rich in organic matter, but with low plant nutrient content, may be applied to raise concentrations of organic matter in soils. Additions of such wastes can temporarily decrease the plant availability of nitrogen in the soil. When these wastes are applied to soils, nitrogen fertilizer application rates may have to be increased to maintain proper crop yields.

4.4 Soil Acidity

Wastes, which have the potential to raise or lower soil pH appreciably, must be applied at rates to achieve a soil pH appropriate for the growth of common agricultural crops, for several years after waste application. Calculations should be submitted along with the application for a Certificate of Approval.

5.0

CRITERIA RELATED TO SPREADING SITES

5.1 Separation Distances Soil Criteria and Waiting Periods

Separation distances, soil criteria and waiting periods will be evaluated, on a case-by-case basis, depending on factors, such as demonstration that concentrations of pathogenic organisms are low (as, for example when sterilization processes have been used) or that industrial organic concentrations tend to zero. Tables 3 and 4 will provide guidance.

5.2 Snow Covered and Frozen Ground

To minimize runoff, wastes should not be spread on frozen or ice covered soil. Waste spreading is acceptable when there is little or no frost in the soil and the surface is snow-covered. For fields having a sustained slope of less than 3%, spreading may be allowed on frozen soil, provided that the risks of runoff have been determined to be minimal. In such cases, the separation distances from surface water courses noted in Table 3 should be doubled. Where surface run-off is expected as a result of snow-melt, a more critical evaluation of the site will be required.

5.3 Eliminating Runoff and Reducing Soil Compaction

Soil tillage and waste application should, where possible, follow the contours of the land. Traffic by spreading vehicles should be minimized to reduce soil compaction.

6.0

HANDLING AND SPREADING

6.1 Waste Application

The maximum depth of fluid waste application at any one time is 1.3 cm. There may be no further application until the preceding application has dried. Criteria for maximum application rates are provided in sections 3.0 and 4.0. Spreading vehicles should have calibrated equipment which can be relied on to control the rate of application. Unsealed tanks, for which gravity flow and ground speed are the only means of adjusting spreading rates, will not spread fluid waste uniformly.

Uniform spreading is essential to ensure that each part of the field receives the same rates of nutrients and metals. Neither fluid nor solid waste may be spread if the vehicles will cause undue compaction or damage soil structure. Spreading vehicles with flotation tires are preferred. Even flotation tires can cause serious soil compaction when the soil is wet. The overall quality of spreading is a major factor affecting the willingness of farmers to continue using wastes.

6.2 Storage and Blending

6.2.1 Requirements for Storage

A Certificate of Approval is required for a waste storage facility other than one located in the location where the waste is produced. Storage may be required during inclement weather and during the waiting periods between spreading and cropping or pasturing. Sufficient storage must be available to retain the waste during these periods.

In Ontario, both earthen lagoons and other facilities are used for waste storage. The waste must meet the Guidelines' criteria at the time when it is spread on land. Therefore, it must be well-mixed, so that it is of uniform quality before it is withdrawn from storage. See also Section 2.2c.

Storage of wastes produced by chemical processes is always required; no batch may be spread until appropriate analyses have been reviewed and/or written permission has been provided by MOE Regional staff. Each batch of wastes actually applied to land must be uniform in quality and have the same composition as those of the sample on which approval for spreading was based. To achieve this, thorough mixing of stored materials may be required. All materials must be spread uniformly and evenly.

6.2.2

Fluid Waste and Manure Blending

The blending of acceptable fluid waste and liquid livestock manure is acceptable, provided adequate storage and land for spreading are available. The spreading rate should not exceed the nitrogen requirement of the crop. No more than 1.3 cm depth of the blended material may be applied at any one time. The total amount of waste applied per 5 years must not supply metals at a rate exceeding that specified in Table 1. It is the farmer's responsibility to spread the mixture in accordance with the Guidelines and the requirements of the Certificate of Approval.

6.3 Responsibilities and Rights

Some of the responsibilities and rights of those involved in waste utilization are outlined below.

6.3.1

Waste Producers

The responsibilities of waste producers are set out below.

a. Record-keeping

Records are to be kept of:

- the location of all fields receiving waste;
- the amount of waste applied to each field; and
- waste analyses.

A report, similar to that shown in Appendix II, is to be provided to the waste spreader. The report shall include data on the waste's average nutrient content per cubic metre. A copy of this report is to be provided to the local office of the Ministry of the Environment.

The agricultural producer shall, on request, be advised of the annual average quantities of metals per cubic metre of waste.

b. Sample Submission

The number of waste samples analyzed must be sufficient to establish representative values for all pertinent parameters. Sampling frequency is subject to approval by MOE Regional staff. See also section 2.2c.

c. Monitoring Application Rates

The waste producer should take steps to verify that the waste application rates conform with those specified in Certificates of Approval.

d. Contingency Planning

Waste producers are required to prepare contingency plans for situations where waste quality fails to meet the requirements of these Guidelines. These situations may be the result of equipment failure or of the need for equipment maintenance; or be occasioned by plans must provide for alternative methods for treatment and/or disposal.

6.3.2

Waste Spreaders

The spreader must spread the waste uniformly on land at the rate required by the farmer. (See section 6.3.3). The actual rates of nitrogen and waste application (in kilograms per hectare and/or in cubic metres per hectare) must not exceed those specified in these guidelines or by the Ministry of the Environment.

The spreader must maintain all required separation distances and comply with other site requirements. Staking of distances from wells, watercourse and residences may facilitate satisfactory spreading.

The spreader must ensure that the agricultural producer receives a report, similar to that shown in Appendix II, as soon as practicable after completing waste application to any field.

The rights of the agricultural producer must be respected with regard to timing and rate of application of waste (see Section 6.3.3).

6.3.3

Agricultural Producers

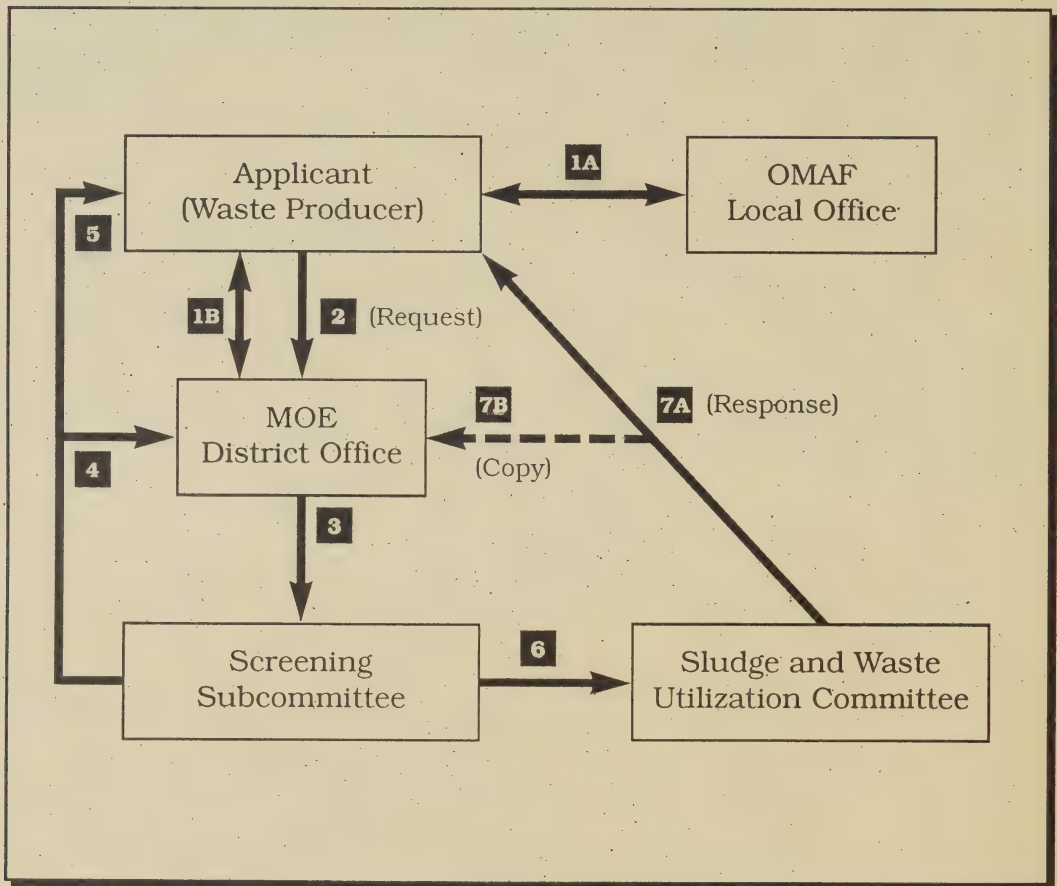
The agricultural producer, the waste spreader and the waste producer should work together to develop a waste utilization program for individual fields. The agricultural producer has the right and the responsibility to insist on program flexibility, so that waste application rates may be adjusted to suit the nitrogen and phosphorus requirements of the crop. In addition, the agricultural producer may direct that waste spreading operations be discontinued immediately.

When nitrogen-rich waste has been applied, agricultural producers should take account of the amount of available nitrogen it contains, by reducing commercial nitrogen fertilizer applications. Ministry of Agriculture and Food local staff can advise farmers on such reductions.

The agricultural producer also has the responsibility to see that appropriate waiting periods between waste spreading and cropping or pasturing are observed. The farmer should also seek advice from intended markets as to other limitations or restrictions which may be applicable.

Agricultural producers will receive a copy of a report, similar to that shown in Appendix II, to help them in their cropping programs.

**Figure 1:
APPROVALS AND CERTIFICATES OF APPROVAL FOR WASTE USE ON LAND
INFORMATION FLOW**



1. Applicant obtains forms, consults with MOE, OMAF.
2. Application sent to MOE District Office.
3. Application checked, sent to Screening Subcommittee.
- 4, 5. Additional information, clarification requested.
6. Subcommittee's findings sent to main Committee.
7. Findings reviewed. Recommendations to applicant.
Copy to MOE District Office.

Table 1:
PERMISSIBLE APPLICATION AND CONCENTRATION ON METAL*

Metal***	Maximum Permissible Metal Application per 5 years (kg/ha)	Maximum Permissible Metal Concentration in Soils** (mg/kg)
ARSENIC	1.4	14
CADMIUM	0.27	1.6
COBALT	2.7	20
CHROMIUM	23.3	120
COPPER	13.6	100
MERCURY	0.09	0.5
MOLYBDENUM	0.08	4
NICKEL	3.56	32
LEAD	9	60
SELENIUM	0.27	1.6
ZINC	33	200

* These criteria are based on tables in the 'Guidelines for Sewage Sludge Utilization on Agricultural Lands', which deal with permissible concentrations of metals in municipal sewage sludge.

** Wastes must not be applied to a soil if, as a result, any of the above metal concentrations would be exceeded.

*** These metals are of significance when sewage sludges are applied to land. Other metals may be of significance and the Ministry of the Environment may control or limit their application.

**Table 2:
SODIUM CRITERIA**

1. The sodium adsorption ratio (SAR) of the soluble fraction of wastes added to soils shall be less than 5. For fluid wastes, the sodium assessed shall be that in the filtrate of a 2:1 water-waste suspension. Sometimes the addition of soluble calcium can reduce unacceptably high SARs. The SAR shall be assessed using the following formula:

$$\text{SAR} = \frac{\text{Na}^+}{\sqrt{\text{Ca}^{2+} + \text{Mg}^{2+}}}$$

The concentrations of Na, Ca and Mg are expressed in (mmol)(dm), i.e. in millimoles per litre.

2. The amounts of sodium which may be added annually, in any waste, to Ontario soils, without seriously damaging the soil structure or reducing crop growth are presented in the following Table:

SUGGESTED MAXIMUM ANNUAL SODIUM ADDITION TO ONTARIO SOILS	
Soil Texture	Annual Maximum Sodium Addition (kg/ha)
Sands, sandy loams.	400
Organic soils, loams, clay loams and clays.	1000

**Table 3:
MINIMUM SEPARATION DISTANCES OF
SPREADING SITES² FROM WATERCOURSES**

Maximum Sustained Slope	Soil¹ Permeability	Distance (metres)
0 - 3 %	Rapid to Moderately Rapid Moderate to Slow	50 100
3 - 6 %	Rapid to Moderately Rapid Moderate to Slow	100 200
6 - 9 %	Rapid to Moderately Rapid Moderate to Slow	150 Not Permitted
> 9 %	All Permeabilities	Not Permitted
Notes: 1. Determine soil permeability in accordance with OMAF's 'Drainage Guide for Ontario'. Determine the soil type from County Soil Maps, also obtainable from OMAF. 2. Spreading must be suspended when run-off is expected. The spreading of fluid waste is not normally permitted when soils are frozen. See Section 5.2.		

Table 4:
OTHER SEPARATION DISTANCES*
 (For additional information, refer to Section 5.0)

Feature	Distance (metres)	Notes
Water Table	0.9	Measured vertically
Bedrock	1.5	Measured vertically
Drilled wells more than 15 m deep	15	Measured horizontally
All other wells including dug wells	90	Measured horizontally
Individual residences	90	Measured horizontally
Residential areas	450	Measured horizontally

Appendix I
SLUDGE SPREADING RESTRICTIONS
RELATED TO PUBLIC HEALTH AND PATHOGENS

Crop	Waiting Period After Application
Hay and Haylage	3 weeks before harvest
Pasture for horses, beef or dairy cattle	2 months before grazing
Pasture for swine, sheep or goats	6 months before grazing
Commercial Sod	12 months before harvest
Small fruits	15 months before harvest
Tree Fruits and grapes	3 months before harvest
Tobacco	Application not recommended
Home lawns and gardens	Application not recommended
Golf Courses and recreational land	Application recommended only if stabilization additional to digestion is used to reduce pathogenic content.

Appendix II

REPORT ON WASTE APPLIED TO AGRICULTURAL LAND

Part A: Average Nutrient Content

(To be completed by the Waste Generator)

Generator Name and Location _____

Waste Description _____

Storage Site Location (when applicable) _____

Nutrient Concentrations in: kg/cubic metre for liquids; and kg/tonne for solids

Nitrogen (as ammonia plus nitrates) _____

Total Phosphorus _____

Potassium _____

Signature of Employee responsible _____

Part B: Restrictions

Part C: Site and Waste Source and Quality Data

(To be completed by the Waste Spreader)

Farm Operator _____ Date _____

Site _____ Field _____

Area Covered _____ (Hectares) .

Total Waste Applied _____ (Cubic metres or kg)

Application Method _____

Hauler's Signature _____

Part C: Comments

Conversion Factors

1 kg = 2.2 lb

1 hectare = 2.5 acres

1 cubic metre = 220 gallons

1 mg/L = .001 kg/cubic metre

